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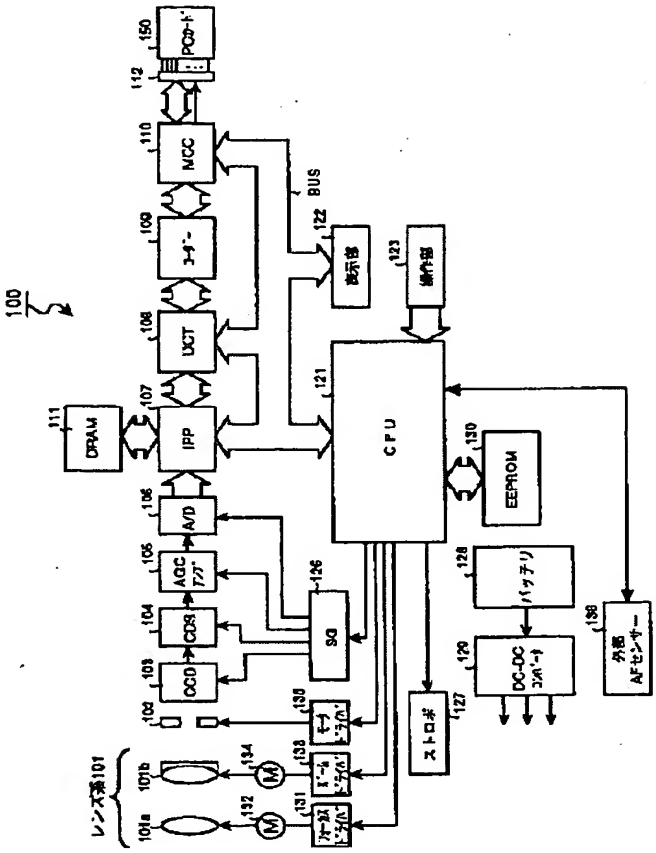
TITLE : AUTOMATIC FOCUSING DEVICE, DIGITAL CAMERA AND PORTABLE INFORMATION INPUT DEVICE



ABSTRACT : PROBLEM TO BE SOLVED: To provide an automatic focusing device capable of accurately detecting a focusing position in a short time and realizing focusing position detecting operation in compliance with user's taste and a photographing purpose.

SOLUTION: This automatic focusing device is equipped with a lens system 101 including a focus lens system 101a forming a subject image at a specified position and a zoom lens system 101b, a CCD 103 picking up the subject image inputted through the lens system 101 and outputting image data, and a CPU 121 deciding a final focusing position based on the detected result of CCD-AF and external AF. The operating condition of the CCD-AF and the external AF can be set by a user.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A lens system including the focal lens system which carries out image formation of the photographic subject image to a predetermined location, An image pick-up means to picturize the photographic subject image inputted through said lens system, and to output image data, The 1st focus location detection means which uses said image pick-up means, is made to move said lens system near the criteria location, samples the contrast of a photographic subject, and detects a focus location, The 2nd focus location detection means which uses a different photo-electric-conversion means from said image pick-up means, detects distance with a photographic subject, and detects the focus location of said lens system, A setting means to set up the operating condition of said 1st focus location detection means and/or the 2nd focus location detection means according to actuation of an operator, Automatic focus equipment characterized by having the focus positioning means which determines a final focus location based on the focus location detected with said 1st focus location detection means and said 2nd focus location detection means.
[Claim 2] Said setting means is automatic focus equipment according to claim 1 characterized by setting up the sampling range at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator.
[Claim 3] Said setting means is automatic focus equipment according to claim 1 characterized by setting up the number of sample takeoff points at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator.
[Claim 4] Said setting means is automatic focus equipment according to claim 1 characterized by setting up the sampling period at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of a photography person.
[Claim 5] Said setting means sets up the priority of said 1st focus location detection means and said 2nd focus location detection means according to actuation of a photography person. Said focus positioning means Automatic focus equipment of any one publication of claim 1 characterized by determining a final focus location based on the focus location detected with the focus location detection means of the priority above 1st, and said 2nd focus location detection means according to the set-up priority - claim 4.
[Claim 6] For said setting means, said lens system is automatic focus equipment of any one publication of claim 1 characterized by relating with the focal distance of said lens system, and setting up the operating condition of said 1st focus location detection means and/or the 2nd focus location detection means according to actuation of an operator - claim 5 including a zoom lens system.
[Claim 7] Automatic focus equipment of any one publication of claim 1 characterized by operating said 1st focus location detection means and said 2nd focus location detection means to abbreviation coincidence when the photography operating member for directing photography is operated - claim 6.
[Claim 8] Precede with actuation of the photography operating member for directing photography, and said 2nd focus location detection means performs ranging processing which

ranges distance with a photographic subject at intervals of predetermined actuation. It is automatic focus equipment of any one publication of claim 1 characterized by to perform actuation which said 1st focus location detection means makes the focus location detected with said 2nd focus location detection means said criteria location when said photography operating member is operated, and detects a focus location – claim 6.
[Claim 9] Said setting means is automatic focus equipment according to claim 8 characterized by setting up spacing of ranging processing of said 2nd focus location detection means of operation according to actuation of an operator.
[Claim 10] The digital camera characterized by applying the automatic focus equipment of any one publication of claim 1 – claim 9.
[Claim 11] The pocket information input unit characterized by applying the automatic focus equipment of any one publication of claim 1 – claim 9.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the automatic focus equipment which detects a focus location by Exterior AF and CCD-AF in a detail, a digital camera, and a pocket information input unit about automatic focus equipment, a digital camera, and a pocket information input unit.

[0002]

[Description of the Prior Art] As an AF method of the conventional electronic "still" camera, the automatic-focusing regulatory mechanism of the CCD-AF method which finds the peak of a focus with the luminance signal accumulated in CCD, and a triangulation method was used independently, driving CCD or a focal lens in the direction of an optical axis.

[0003]

[Problem(s) to be Solved by the Invention] However, as shown in drawing 22 , the above-mentioned CCD-AF method drives CCD or a focal lens from infinite distance to the maximum near one, and since it is a method which finds the crest of a focus, it has the problem of taking time amount before detecting a focus location. In order to solve an above-mentioned problem, as are shown in drawing 23 (a), and it goes a rough sampling from infinite distance to the maximum near one, and it detects and continues and the focus location of an outline is shown in drawing 23 (b), by the CCD-AF method, the method which performs a fine sampling near the focus location of an outline, and detects a final focus location is also proposed. According to this method, although the detection time of a focus location can be shortened a little, it cannot be said that it is enough.

[0004] moreover, area to double a focus, as for a CCD-AF method -- high -- when there are brightness photographic subjects (the flame of an electric bulb and a candle, signboard currently reflected), the crest of a focus cannot be discovered but there is a problem of ******(ing). Furthermore, there is a problem that there is possibility of an incorrect focus, also in a dark scene. Moreover, by the above-mentioned triangulation method, it is easy to generate a parallax gap of ranging by the side of point-blank range, and there are problems, like the engine performance by the side of looking far is low.

[0005] By the way, above-mentioned AF was automatically performed by the equipment side, and since a user was not able to set up the operating condition of AF etc., there was a problem that AF actuation according to a user's liking and photography purpose was unrealizable.

[0006] This invention aims at offering the automatic focus equipment which it is made in view of the above, and it is a short time, and a focus location can be detected correctly, and can realize focus location detection actuation according to a user's liking and photography purpose, a digital camera, and a pocket information input unit.

[0007]

[Means for Solving the Problem] In order to solve the technical problem mentioned above, invention concerning claim 1 A lens system including the focal lens system which carries out image formation of the photographic subject image to a predetermined location, An image pick-up means to picturize the photographic subject image inputted through said lens system, and to output image data, The 1st focus location detection means which uses said image pick-up means, is made to move said lens system near the criteria location, samples the contrast of a photographic subject, and detects a focus location, The 2nd focus location detection means which uses a different photo-electric-conversion means from said image pick-up means, detects distance with a photographic subject, and detects the focus location of said lens system, A setting means to set up the operating condition of said 1st focus location detection means and/or the 2nd focus location detection means according to actuation of an operator, Based on the focus location detected with said 1st focus location detection means and said 2nd focus location detection means, it has the focus positioning means which determines a final focus location.

[0008] According to the above-mentioned invention, a lens system carries out image

formation of the photographic subject image to a predetermined location, an image pick-up means picturizes the photographic subject image inputted through a lens system, and outputs image data, and the 1st focus location detection means uses an image pick-up means. Move a lens system near the criteria location, sample the contrast of a photographic subject, detect a focus location, and said 2nd focus location detection means uses a different photo-electric-conversion means from an image pick-up means. Detect distance with a photographic subject, detect the focus location of a lens system, and a setting means responds to actuation of an operator. Setting up the operating condition of the 1st focus location detection means and/or the 2nd focus location detection means, a focus positioning means determines a final focus location based on the focus location detected with the 1st focus location detection means and the 2nd focus location detection means.

[0009] Moreover, in invention which invention concerning claim 2 requires for claim 1, said setting means sets up the sampling range at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator. According to the above-mentioned invention, a setting means sets up the sampling range at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator.

[0010] Moreover, in invention which invention concerning claim 3 requires for claim 1, said setting means sets up the number of sample takeoff points at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator. According to the above-mentioned invention, a setting means sets up the number of sample takeoff points at the time of the 1st focus location detection means detecting the contrast of a photographic subject according to actuation of an operator.

[0011] Moreover, in invention which invention concerning claim 4 requires for claim 1, said setting means sets up the sampling period at the time of said 1st focus location detection means detecting the contrast of a photographic subject according to actuation of a photography person. According to the above-mentioned invention, a setting means sets up the sampling period at the time of the 1st focus location detection means detecting the contrast of a photographic subject according to actuation of a photography person.

[0012] In invention which invention concerning claim 5 requires for any one of claim 1 - the claims 4 moreover, said setting means According to actuation of a photography person, the priority of said 1st focus location detection means and said 2nd focus location detection means is set up. Said focus positioning means According to the set-up priority, a final focus location is determined based on the focus location detected with the focus location detection means of the priority above 1st, and said 2nd focus location detection means. A setting means sets up the priority of the 1st focus location detection means and the 2nd focus location detection means according to actuation of a photography person, and, according to the above-mentioned invention, a focus positioning means determines a final focus location according to the set-up priority based on the focus location detected with the 1st focus location detection means and the 2nd focus location detection means.

[0013] Moreover, including a zoom lens system, invention ******** which invention concerning claim 6 requires for any one of the claims 1-5, and said lens system relate said setting means with the focal distance of said lens system according to actuation of an operator, and set up the operating condition of said 1st focus location detection means and/or the 2nd focus location detection means. According to the above-mentioned invention, according to actuation of an operator, a setting means is related with the focal distance of a lens system, and sets up the operating condition of the 1st focus location detection means and/or the 2nd focus location detection means.

[0014] Moreover, in invention concerning any one of claim 1 - the claims 6, invention concerning claim 7 operates said 1st focus location detection means and said 2nd focus location detection means to abbreviation coincidence, when the photography operating member for directing photography is operated.

[0015] Moreover, invention concerning claim 8 is set to invention concerning any one of claim 1 - the claims 6. Precede with actuation of the photography operating member for directing

photography, and the 2nd focus location detection means performs ranging processing which ranges distance with a photographic subject at intervals of predetermined actuation. When said photography operating member is operated, said 1st focus location detection means performs actuation which detects a focus location by making into said criteria location the focus location detected with said 2nd focus location detection means. It precedes with actuation of the photography operating member for directing photography according to the above-mentioned invention, and when the ranging processing to which the 2nd focus location detection means ranges distance with a photographic subject performed and a photography operating member was operated, the 1st focus location detection means performs the actuation carry out the focus location detected with the 2nd focus location detection means as a criteria location, and detect a focus location at intervals of predetermined actuation.
[0016] Moreover, in invention which invention concerning claim 9 requires for claim 8, said setting means sets up spacing of ranging processing of said 2nd focus location detection means of operation according to actuation of an operator. According to the above-mentioned invention, a setting means sets up spacing of ranging processing of said 2nd focus location detection means of operation according to actuation of an operator.
[0017] Moreover, invention concerning claim 10 applies the automatic focus equipment concerning any one of claim 1 - the claims 9. According to the above-mentioned invention, the automatic focus equipment concerning any one of claim 1 - the claims 9 is applied to a digital camera.
[0018] Moreover, invention concerning claim 11 applies the automatic focus equipment concerning any one of claim 1 - the claims 9. According to the above-mentioned invention, the automatic focus equipment concerning any one of claim 1 - the claims 9 is applied to a pocket information input unit.
[0019]
[Embodiment of the Invention] With reference to an accompanying drawing, the gestalt of suitable operation of the automatic focus equipment concerning this invention, a digital camera, and Personal Digital Assistant equipment is explained below at a detail.
[0020] Drawing_1 is the block diagram of the digital camera which applied the automatic focus equipment concerning this invention. In this drawing, 100 shows the digital camera. A digital camera 100 A lens system 101, a diaphragm, the filter section, etc. The mechanism device 102 to include, CCD103, the CDS circuit 104, a variable gain amplifier (AGC amplifier) 105, A/D converter 106, IPP107 and DCT108, a coder 109, MCC110 and DRAM111, the PC card interface 112, CPU121, A display 122, a control unit 123, SG The section 126, a strobe lighting system 127, a dc-battery 128, DC-DC converter 129, EEPROM130, the focal driver 131, a pulse motor 132, the zoom driver 133, a pulse motor 134, Motor Driver 135, (Control signal generation) The external AF sensor 136 is provided and it is constituted. Moreover, removable PC card 150 is connected through the PC card interface 112.
[0021] A lens unit consists of a mechanism device 102 containing a lens system 101, a diaphragm, the filter section, etc., and the mechanical shutter of the mechanism device 102 performs coincidence exposure of the two fields. A lens system 101 consists for example, of a BARIFOKARU lens, and consists of focal lens system 101a and zoom lens system 101b.
[0022] According to the control signal supplied from CPU121, the focal driver 131 drives a pulse motor 132, and moves focal lens system 101a in the direction of an optical axis. According to the control signal supplied from CPU121, the zoom driver 133 drives a pulse motor 134, and moves zoom lens system 101b in the direction of an optical axis. Moreover, Motor Driver 135 drives the mechanism device 102 according to the control signal supplied from CPU121, for example, sets up the drawing value of a diaphragm.
[0023] CCD (charge-coupled device)103 changes into an electrical signal (analog image data) the image inputted through the lens unit. The CDS (correlation duplex sampling) circuit 104 is a circuit for the reduction in a noise to a CCD mold image sensor.
[0024] Moreover, the AGC amplifier 105 amends the level of the signal by which the correlation duplex sampling was carried out in the CDS circuit 104. In addition, the gain of the AGC amplifier 105 is set up by setting setting data (control electrical potential difference) as

the AGC amplifier 105 by CPU121 through the D/A converter which CPU121 builds in. Furthermore, A/D converter 106 changes into digital image data the analog image data from CCD103 inputted through the AGC amplifier 105. That is, the output signal of CCD103 is changed into a digital signal by A/D converter 106 through the CDS circuit 104 and the AGC amplifier 105 with the optimal sampling frequency (for example, integral multiple of the subcarrier frequency of an NTSC signal).

[0025] Moreover, about the digital image data inputted from A/D converter 106, IPP (Image Pre-Processor)107 and DCT (Discrete Cosine Transform)108 which are the digital-signal-processing section, and a coder (Huffman Encoder/Decoder) 109 are divided into the color difference (Cb, Cr) and brightness (Y), and perform data processing for various processings, amendment, and picture compression/expanding. The Huffman coding, the decryption, etc. it is [decryption] passing away of the picture compression and expanding of JPEG conformity are performed in the orthogonal transformation and the reverse orthogonal transformation, and the list DCT108 and a coder 109 are [list] like passing away of the picture compression and expanding of JPEG conformity for example.

[0026] Furthermore, MCC (Memory Card Controller)110 once stores the image by which compression processing was carried out, and performs record to PC card 150, or read-out from PC card 150 through the PC card interface 112.

[0027] According to the program stored in ROM, RAM is used for CPU121 as a working area, and it controls all actuation inside the above-mentioned digital camera according to external actuation actuation of the remote control which is not operated or illustrated from a control unit 123. Specifically, CPU121 controls image pick-up actuation, automatic exposure (AE) actuation, automatic white balance (AWB) adjustment actuation, AF actuation, etc.

[0028] Moreover, from a dc-battery 128, for example, NiCd, nickel hydrogen, a lithium cell, etc., a camera power source is inputted into DC-DC converter 129, and is supplied to the interior of the digital camera concerned.

[0029] LCD, LED, EL, etc. realize and a display 122 displays the photoed digital image data, record image data, a setting screen by which expanding processing was carried out, etc. The control unit 123 is equipped with the carbon button for performing the zoom key for setting up the release key for performing photography actuation, and the zoom location of zoom lens system 101b, a selection of function, and various other setup from the outside etc. CPU121 will perform AF actuation etc., if are half-push [a release key] and RL-1 is set to ON, and are all push [a release key], and if RL-2 are set to ON, it will perform photography actuation. The adjustment data used in case CPU121 controls actuation of a digital camera are written in EEPROM130.

[0030] The above-mentioned digital camera 100 (CPU121) is equipped with the recording mode which records the image data which picturizes a photographic subject and is obtained on PC card 150, the display mode which displays the image data recorded on PC card 150, the monitoring mode which displays the picturized image data directly on a display 122.

[0031] Drawing 2 is drawing showing an example of the concrete configuration of the above IPP 107. The color separation section 1071 which divides into each color component of R-G-B the digital image data inputted from A/D converter 106 as IPP107 is shown in drawing 2 , The signal interpolation section 1072 which interpolates each image data of separated R-G-B, The pedestal controller 1073 which adjusts the black level of each image data of R-G-B, The white balance controller 1074 which adjusts the white level of each image data of R and B, The digital gain controller 1075 which amends each image data of R-G-B by the gain set up by CPU121, The gamma transducer 1076 which performs gamma conversion of each image data of R-G-B, It has the matrix section 1077 which divides the image data of RGB into a color-difference signal (Cb, Cr) and a luminance signal (Y), and the video signal processing section 1078 which creates a video signal based on a color-difference signal (Cb, Cr) and a luminance signal (Y), and is outputted to a display 122.

[0032] Furthermore, the Y operation part 1079 to which IPP107 detects the brightness data (Y) of the image data after the pedestal adjustment by the pedestal controller 1073, BPF1080 which passes only the predetermined frequency component of the brightness data (Y)

detected by the Y operation part 1079, AF evaluation value circuit 1081 outputted to CPU121 by making into AF evaluation value the integral value of the brightness data (Y) which passed BPF1080, AE evaluation value circuit 1082 outputted to CPU121 by making into AE evaluation value digital counted value according to the brightness data (Y) detected by the Y operation part 1079, The Y operation part 1083 which detects the brightness data (Y) of each image data of R-G-B after adjustment by the white balance controller 1074, The AWB evaluation value circuit 1084 which counts the brightness data (Y) of each color detected by the Y operation part 1083, respectively, and is outputted to CPU121 as an AWB evaluation value of each color, It has the DCTI/F1086 grade which is the interface of CPUI/F1085 which is an interface with CPU121, and DCT108.

[0033] The external AF sensor 136 of drawing 1 is for consisting of a ranging sensor of a passive method and ranging the distance of a photographic subject. Drawing 3 is drawing showing the outline configuration of an external AF sensor. The external AF sensor 136 is equipped with a lens 151, the photosensor arrays 152a (left-hand side) and 152b (right-hand side), and an arithmetic circuit (un-illustrating). With reference to drawing 3 and drawing 4 , the ranging principle of the external AF sensor 136 is explained. In drawing 3 the distance to a photographic subject d, a lens 151 and photosensor array 152a (left-hand side), If distance between photosensor array 152a to which incidence of X1, X2, and the light is carried out, respectively in the width of face of the light which inputs distance with 152b (right-hand side) into f and the photosensor arrays 152a (left-hand side) and 152b (right-hand side), and 152b is set to B The distance d from the front face of the external AF sensor 136 to a photographic subject is computable by d=B-f/(X1+X2) with triangulation. Drawing 4 shows the photographic subject image of a photosensor array on either side, and an arithmetic circuit integrates with the quantity of light of the photographic subject image of each photosensor array, is calculating a gap of right-and-left sensor data, computes the distance d of a photographic subject, and outputs it to CPU121.

[0034] In this specification, the actuation which detects a focus location using the external AF sensor 136 is called exterior AF, and the case where a focus location is detected using CCD103 is called CCD-AF (interior AF). In CCD-AF, focal lens 101a is moved, AF evaluation value which shows the contrast of the photographic subject according to the picture signal outputted from CCD103 is sampled, and the mountain-climbing servo system which makes the peak location of AF evaluation value a focus location is used. It is called high Brit AF to perform AF using Exterior AF and CCD-AF.

[0035] Below, a setup of AF conditions is explained. Drawing 5 shows the own alternative screen in AF mode displayed on the display screen 160 of a display 122 by operating the key of a control unit 123. "1st AF mode" and "2nd AF mode" are expressed as the own alternative screen in AF mode shown in this drawing. If "1st AF mode" or "2nd AF mode" is chosen by the cursor key of a control unit 123 and the depression of the enter key of a control unit 123 is carried out, selected AF mode will be set up. In 1st AF mode, abbreviation coincidence performs CCD-AF and Exterior AF. Moreover, in 2nd AF mode, it precedes with CCD-AF and Exterior AF is performed. The detail of AF actuation in this 1st and 2nd AF mode is mentioned later.

[0036] Drawing 6 shows the own alternative screen of the priority of AF displayed on the display screen 160 of a display 122 by operating the carbon button of a control unit 123. Priority" and automatic ["automatic"] are expressed [result / of "CCD-AF] as the own alternative screen of the priority of AF shown in this drawing in the result of priority" and "external AF. Priority" and the priority of AF chosen when priority" or automatic ["automatic"] were chosen for the result of "external AF and the depression of the enter key of a control unit 123 was carried out are set up in the result of "CCD-AF by the cursor key of a control unit 123. When priority" is set up in the result of "CCD-AF, the result of CCD-AF is preferentially determined as the last focus location. Moreover, when priority" is set up in the result of "external AF, the result of Exterior AF is preferentially determined as the last focus location. Moreover, when "automatic" is set up, the last focus location is determined based on the detection result of CCD-AF and Exterior AF.

[0037] Drawing 7 shows the own alternative screen of AF conditions displayed on a display 122 by operating the key of a control unit 123. The setting item of "the sampling range of CCD-AF", the "number of sample takeoff points of CCD-AF", "the sampling period of CCD-AF", and "spacing of Exterior AF of operation" is expressed as the own alternative screen of AF conditions shown in this drawing. If the item set up by the cursor key of a control unit 123 is chosen and the depression of the enter key of a control unit 123 is carried out, the own alternative screen of the corresponding setting item will be displayed.
[0038] Drawing 8 shows the own alternative screen of the sampling range of CCD-AF. this drawing -- setting -- narrow - standard - in the large thing sampling range, the cursor key of a control unit 123 is operated, the cursor 161 in drawing is moved, the sampling range is chosen, and it decides by the enter key of a control unit 123. Thereby, the sampling range of CCD-AF is set up. Drawing 9 is an explanatory view for explaining the sampling range in the case of performing CCD-AF (successive range of focal lens system 101a). In this drawing, an axis of abscissa shows a lens location (near - infinity), an axis of ordinate shows the contrast (AF evaluation value) of a photographic subject, and a of this drawing shows the sampling range (sampling width of face). The sampling range a is set up by the operator on the selection screen of above-mentioned drawing 8 . Thereby, when performing CCD-AF, it becomes possible to determine whether to think a rate as important for whether precision is thought as important according to an operator's liking and application.
[0039] Drawing 10 shows the own alternative screen of the number of sample takeoff points of CCD-AF. this drawing -- setting -- little - standard - from many numbers of thing sample takeoff points, the cursor key of a control unit 123 is operated, the cursor 161 in drawing is moved, the number of sample takeoff points is chosen, and it decides by the enter key of a control unit 123. Thereby, the number of samplings of CCD-AF is set up. Drawing 11 is an explanatory view for explaining the number of sample takeoff points of CCD-AF. This drawing is an explanatory view for explaining the sampling period of AF evaluation value over the movement magnitude of focal lens system 101a of CCD-AF, an axis of abscissa shows a lens location (near - infinity), an axis of ordinate shows the contrast (AF evaluation value) of a photographic subject, and b shows the sampling period of AF evaluation value. The number of sample takeoff points in sampling within the limits set up is set up by the operator on the selection screen of above-mentioned drawing 10 . Thereby, when performing CCD-AF, it becomes possible to determine whether to think a rate as important for whether precision is thought as important according to an operator's liking and application.
[0040] Drawing 12 shows the own alternative screen of the sampling period of CCD-AF. this drawing -- setting -- quick - standard - from late thing sampling periods, the cursor key of a control unit 123 is operated, the cursor 161 in drawing is moved, a sampling period is chosen, and it decides by the enter key of a control unit 123. Thereby, the sampling period of CCD-AF is set up. Drawing 13 shows the range of AF area of the light-receiving side of CCD103 in the case of sampling AF evaluation value by CCD-AF. This AF area shows the range which acquires AF evaluation value. This drawing shows the horizontal 15 and the case where it divides perpendicular 10 for the light-receiving side of CCD103, and CPU121 can set up AF area of the magnitude of arbitration in the light-receiving side of CCD103. The sampling period of CCD-AF is changed by changing the magnitude of AF area. In making the sampling period of CCD-AF late, as shown in drawing 13 (a), the whole screen of CCD103 is set as AF area, AF evaluation value is sampled about the whole screen, and it samples AF evaluation value with a late sampling period. On the other hand, in making the sampling period of CCD-AF late, as shown in drawing 13 (b), only the central part of a screen is set as AF area, AF evaluation value is sampled only about the central part of a screen, and it samples AF evaluation value with an early sampling period. If the range of the image which should be processed since the sampling period of CCD-AF becomes settled by image-processing time amount if it adds is narrowed, a sampling will become possible with the part and a quick period. The sampling period (magnitude of AF area) of CCD-AF is set up by the operator on the own alternative screen of above-mentioned drawing 12 . Thereby, when performing CCD-AF, it becomes possible to determine whether to think a rate as important for whether

precision is thought as important according to an operator's liking and application.
[0041] Drawing 14 shows the user setting screen of spacing of Exterior AF of operation. Spacing of this exterior AF of operation is operating-time spacing of the ranging processing of Exterior AF performed by preceding with CCD-AF, when 2nd AF mode is chosen. this drawing -- setting -- short - standard - from spacing of the long thing exterior AF of operation, the cursor key of a control unit 123 is operated, the cursor 161 in drawing is moved, spacing of operation is chosen, and it decides by the enter key of a control unit 123. For example, when setting up spacing of Exterior AF of operation for a long time in thinking a battery life as important, and requiring snapshot nature, spacing of Exterior AF of operation is set up short. Since spacing of Exterior AF of operation is set up by the operator on the own alternative screen of above-mentioned drawing 13 , when performing Exterior AF, it becomes possible to determine spacing of Exterior AF of operation according to an operator's liking and application.
[0042] Below, the example of operation in AF mode of the above 1st and 2nd AF mode is explained. In 1st AF mode, CCD-AF and Exterior AF are performed to abbreviation coincidence, in 2nd AF mode, it precedes with CCD-AF and Exterior AF is performed.
[0043] (1st AF mode) Actuation in 1st AF mode is explained with reference to drawing 15 and drawing 16 . Drawing 15 is a flow chart for explaining the example in 1st AF mode of the digital camera performed by control of CPU121 of operation.
[0044] In drawing 15 , CPU121 judges first whether were half-push [the release key] and RL-1 was set to ON (step S1). When are half-push [a release key] and RL-1 is turned on, CPU121 sets focal lens system 101a as the starting position (criteria location) of CCD-AF (step S2). As a starting position (criteria location) of CCD-AF, the present position of a lens system 101 can be used, for example. Usually, it is because it is thought that the frequency continuously photoed on the same conditions is high.
[0045] And CPU121 makes abbreviation coincidence start Exterior AF and CCD-AF (step S3). In Exterior AF, by the external AF sensor 136, ranging processing is performed, measurement of distance with a photographic subject is performed, and detection of a focus location is performed. Moreover, at CCD-AF, focal lens system 101a is moved near the criteria location, on the conditions (the sampling range, the number of sample takeoff points, sampling period) set up, AF evaluation value is acquired and detection of a focus location is performed.
[0046] Then, when it judges whether Exterior AF ended CPU121 (step S4) and Exterior AF is completed, it judges whether the range measurement results of Exterior AF differ the photography distance corresponding to the starting position (criteria location) of CCD-AF, and beyond a predetermined value (step S5). When the range measurement results of Exterior AF do not differ the photography distance corresponding to the starting position (criteria location) of CCD-AF, and beyond a predetermined value as a result of this decision, it shifts to step S8. On the other hand, when the range measurement results of Exterior AF differ the photography distance corresponding to the starting position (criteria location) of CCD-AF, and beyond a predetermined value, CPU121 interrupts CCD-AF, makes the location corresponding to the distance measured by the external AF sensor 136 a new criteria location, and moves focal lens system 101a to the criteria location concerned (step S6). It continues and CCD-AF is rerun near the criteria location concerned (step S7). On the conditions (the sampling range, the number of sample takeoff points, sampling period) to which CCD-AF in this case was also set, AF evaluation value is acquired and detection of a focus location is performed.
[0047] At step S8, when it judges whether CCD-AF ended CPU121 and CCD-AF is completed, based on the priority of AF set up, the last focus location is determined from the focus location detected in CCD-AF and Exterior AF.
[0048] For example, when priority" is chosen in the result of "CCD-AF (refer to drawing 6), the result of CCD-AF is preferentially determined as the last focus location. Moreover, when priority" is chosen in the result of "external AF (refer to drawing 6), the result of Exterior AF is preferentially determined as the last focus location. On the other hand, when the ranging result detected for example, in the exterior AF when "automatic" was chosen (refer to

drawing 6) does not differ from the photography distance corresponding to the focus location detected by CCD-AF beyond a predetermined value, the focus location of CCD-AF is determined as the last focus location. And when the ranging result detected in Exterior AF differs from the photography distance corresponding to the focus location detected by CCD-AF beyond a predetermined value, according to a photographic subject, the focus location of Exterior AF or the focus location of CCD-AF is determined as the last focus location based on the information about the dependability of Exterior AF and CCD-AF.
[0049] CPU121 moves focal lens system 101a to the focus location which determined by carrying out like the above (step S9). Then, if are all push [a release key] and RL-2 are set to ON, photography actuation will be performed, the image data of a photographic subject will be incorporated, and it will record on PC card 150.
[0050] Drawing 16 shows the timing chart for explaining the activation timing of Exterior AF and CCD-AF in 1st AF mode. This drawing (a) shows timing in case the range measurement result of Exterior AF differs from the photography distance corresponding to the starting position (criteria location) of CCD-AF beyond a predetermined value. The range measurement result of Exterior AF differs from the photography distance corresponding to the starting position (criteria location) of CCD-AF beyond a predetermined value, this drawing (b) interrupts CCD-AF, the location corresponding to the distance measured by the external AF sensor 136 is made into a new criteria location, and (**) is shown when CCD-AF is performed again.
[0051] (2nd AF mode) Actuation in 2nd AF mode is explained with reference to drawing 17 - drawing 21 . Drawing 17 is a flow chart for explaining the example in 2nd AF mode of the digital camera performed by control of CPU121 of operation.
[0052] In drawing 17 , first, if a power source is switched on (step S21), CPU121 judges whether it is external AF activation timing (step S22), and when it is not the activation timing of Exterior AF as a result of this decision, it will shift to step S24. On the other hand, if it is external AF activation timing, ranging processing by Exterior AF is performed (step S23), and the external AF sensor 136 will range distance with a photographic subject, and will shift to step S24. Ranging processing of the exterior AF in this case is performed at intervals of the set-up actuation (refer to drawing 14).
[0053] At step S24, CPU121 judges whether were half-push [the release key] and RL-1 key was turned on. When RL-1 is not ON, external AF ranging processing is performed to the activation timing of Exterior AF until return and RL-1 are turned on by step S22. On the other hand, at step S24, when RL-1 is turned on, CPU121 computes the starting position (criteria location) of CCD-AF based on the ranging result of Exterior AF (step S25).
[0054] Here, based on the ranging result of Exterior AF, how to compute the starting position (criteria location) of CCD-AF is explained. For example, the approach of predicting a criteria location from the ranging result of the two past of Exterior AF can be used. According to this, a photographic subject becomes possible [judging whether it approaches or it is keeping away, and whether it has stopped].
[0055] Drawing 18 shows the explanatory view for explaining the case where the starting position (criteria location) of CCD-AF is computed from the range measurement result of the two latest past of Exterior AF. In this drawing, the photographic subject distance (criteria location of CCD-AF) Lccd is predicted to be, a photographic subject distance according [L2] to the exterior AF in front of release actuation, a photographic subject distance according [L1] from L2 to the exterior AF of 1 more time ago, and t1 show spacing of the continuous exterior AF, and t2 shows the time amount from the outside AF in front of release actuation to release. The photographic subject distance (criteria location of CCD-AF) Lccd predicted is computed by the bottom type. And the location of the lens system corresponding to the computed photographic subject distance Lccd which is predicted is determined as the starting position (criteria location) of CCD-AF.
[0056]
When it carries out to Lccd=L2+t2x (L2-L1) / t1, t1=t2 [for example,], and the past 2 times are 2m and 3m, and 4m, another side, and the past 2 times are next 4m and 3m, next, it is

predicted as 2m. Therefore, CCD-AF will be carried out in the location of the lens system corresponding to 4m and 2m order, respectively.
[0057] In addition, although it decided to determine the criteria location of CCD-AF from the two past, you may decide to use the three past or the time series data beyond it here. Thereby more fine dynamic body prediction is attained. For example, when determining the criteria location of CCD-AF from the three past, it also becomes possible to judge whether a photographic subject approaches or is keeping away, it has stopped, or it is shaking to order. For example, the acceleration component of photographic subject migration is also detectable by comparing the 1st time and the 2nd time and the 2nd time with the 3rd photographic subject distance. In this case, the approach (photographic subject which falls from a top) of approximating with a secondary curve, the approach (photographic subject which has ridden on the swing) of approximating by the trigonometric function, etc. can be used.
[0058] And CPU121 moves focal lens system 101a to the starting position (criteria location) of computed CCD-AF (step S26). It continues, and CPU121 makes coincidence start Exterior AF and CCD-AF, after moving focal lens system 101a to a criteria location (step S27). In Exterior AF, by the external AF sensor 136, measurement of distance with a photographic subject is performed and detection of a focus location is performed. Moreover, at CCD-AF, focal lens system 101a is moved near the criteria location, on the conditions (the sampling range, the number of sample takeoff points, sampling period) set up, AF evaluation value is acquired and detection of a focus location is performed.
[0059] When it next judges whether Exterior AF and CCD-AF ended CPU121 (step S28) and Exterior AF and CCD-AF are completed, based on the priority of AF set up, the last focus location is determined from the focus location detected in CCD-AF and Exterior AF.
[0060] For example, when priority" is chosen in the result of "CCD-AF (refer to drawing 6), the result of CCD-AF is preferentially determined as the last focus location. Moreover, when priority" is chosen in the result of "external AF (refer to drawing 6), the result of Exterior AF is preferentially determined as the last focus location. On the other hand, when the ranging result detected for example, in the exterior AF when "automatic" was chosen (refer to drawing 6) does not differ from the photography distance corresponding to the focus location detected by CCD-AF beyond a predetermined value, the focus location of CCD-AF is determined as the last focus location. And when the ranging result detected in Exterior AF differs from the photography distance corresponding to the focus location detected by CCD-AF beyond a predetermined value, according to a photographic subject, the focus location of Exterior AF or the focus location of CCD-AF is determined as the last focus location based on the information about the dependability of Exterior AF and CCD-AF.
[0061] Then, CPU121 moves focal lens system 101a to the determined focus location (step S29). Then, if are all push [a release key] and RL-2 are set to ON, photography actuation will be performed, the image data of a photographic subject will be incorporated, and it will record on PC card 150.
[0062] With reference to drawing 19 , the activation timing of Exterior AF and CCD-AF in 2nd AF mode is explained. Drawing 19 shows the timing chart for explaining the activation timing of Exterior AF and CCD-AF in 2nd AF mode. As for (b), when release is pushed to the activation timing of Exterior AF and release is pushed during the pause of Exterior AF, as for (a) of this drawing, (c) shows timing when, as for (d), release is pushed during external AF actuation (the 2), when release is pushed during external AF actuation (the 1).
[0063] As shown in this drawing (a), when release is pushed to the activation timing of Exterior AF, Exterior AF and CCD-AF are performed to the timing of ON of release. Moreover, as shown in this drawing (b), when release is pushed during an external AF pause, the pause of Exterior AF is ended and Exterior AF and CCD-AF are performed to the timing of ON of release. When release is pushed during external AF actuation, the timing shown in this drawing (c) and the timing shown in this drawing (d) can be considered, and you may decide to use which timing.
[0064] When release is pushed during external AF actuation, as shown in this drawing (c), you may decide to stop and re-drive external AF** at the time of release. In this case, the data of

external AF** will judge a final focus location based on the result of the data of ** of Exterior AF, and CCD-AF without acquiring.
[0065] Moreover, when release is pushed during external AF actuation, as shown in this drawing (d), external AF** will not be interrupted at the time of release, either, but a final focus location will be judged based on the result of the data of external AF**, and CCD-AF in it. Usually, since external AF operating time is 0.1 or less seconds, there is no real use top problem also in the method of (d). However, since, as for the cases at the time of low brightness etc., the time amount around 0.1 seconds requires a photographic subject also in Exterior AF, the method of (c) is trustworthier.
[0066] In addition, in the above-mentioned step S28, when the ranging result detected in Exterior AF differs from the photography distance corresponding to the focus location detected by CCD-AF beyond a predetermined value, as shown in drawing 20 , you may decide to change the starting position (criteria location) of CCD-AF and to perform CCD-AF again.
[0067] Drawing 21 shows the explanatory view for explaining AF mode of the above 2nd. In this drawing, an axis of ordinate shows contrast (AF evaluation value), and the axis of abscissa shows the lens location (near - infinity). First, Exterior AF detects a focus location, subsequently, near the detected focus location concerned, a fine sampling is performed by CCD-AF and a focus location is detected. And a final focus location is determined based on both the focus location.
[0068] As explained above, when were half-push [the release key] and RL-1 was set to ON in 1st AF mode in the gestalt of this operation, since CCD-AF and Exterior AF are performed to abbreviation coincidence, after performing Exterior AF, as compared with the case where CCD-AF is performed based on the result of Exterior AF, it becomes possible to shorten AF time amount.
[0069] In the gestalt of this operation moreover, in 2nd AF mode Also in the condition that will precede with the depression of a release key, namely, a release key will not be pressed if ON of a power source is made When ranging processing is performed in Exterior AF at the predetermined spacing and a release key is pressed Since the criteria location in the case of performing CCD-AF based on the ranging result of Exterior AF is computed and CCD-AF is performed near the criteria location concerned After a release key is pressed, as compared with the case where perform Exterior AF and CCD-AF is performed after that based on the result of Exterior AF, it becomes possible to shorten AF time amount.
[0070] Moreover, in the gestalt of this operation, since the operator enabled a setup of the operating condition in the case of performing CCD-AF and/or Exterior AF etc., it becomes possible to set up the operating environment of AF according to a user's liking and application, and AF actuation according to a user's liking and application can be realized.
[0071] Moreover, in the gestalt of this operation, since the operator enabled a setup of the sampling range in the case of performing CCD-AF, when performing CCD-AF, it becomes possible to determine any shall be thought as important between precision and a rate according to an operator's liking and application.
[0072] Moreover, in the gestalt of this operation, since the operator enabled a setup of the sampling period in the case of performing CCD-AF, when performing CCD-AF, it becomes possible to determine any shall be thought as important between precision and a rate according to an operator's liking and application.
[0073] Moreover, in the gestalt of this operation, since the operator enabled a setup of the number of samplings in the case of performing CCD-AF, when performing CCD-AF, it becomes possible to determine any shall be thought as important between precision and a rate according to an operator's liking and application.
[0074] In addition, when an operator sets up the operating condition (the sampling range, the number of samplings, sampling period) of CCD-AF, you may decide to set the operating condition (the sampling range, the number of samplings, sampling period) of CCD-AF to every [of zoom lens system 101b] zoom location (wide [call, MIN and]). Thereby, a setup of the operating condition (the sampling range, the number of samplings, sampling period) of CCD-AF according to the focal distance of a lens system 101 is attained. Generally, since the required

accuracy and the amount of lens deliveries of AF change with focal distances, when it relates with a focal distance and an operator enables a setup of the operating condition of AF, warmer AF actuation can be realized and it becomes possible to perform AF doubled with liking of a user individual.

[0075] Moreover, in the gestalt of this operation, since the operator enabled a setup of spacing of ranging processing of the exterior AF in 2nd AF mode of operation When setting up spacing of Exterior AF of operation for a long time in thinking a battery life as important, and requiring snapshot nature, spacing of Exterior AF of operation can be set up short, and when performing ranging processing in Exterior AF, it becomes possible to determine spacing of Exterior AF of operation according to an operator's liking and application.

[0076] Moreover, in the gestalt of this operation, since the operator enabled a setup of CCD-AF in the case of determining the last focus location, and the priority of Exterior AF, those to whom CCD-AF photos many photographic subjects weak, for example can give priority to the result of Exterior AF, and it becomes possible to raise focus precision more.

[0077] Moreover, with the gestalt of this operation, as an external AF sensor since the ranging sensor of a passive method is used, a miniaturization, low-cost-izing, and simplification of processing are attained.

[0078] In addition, this invention is not limited to the above-mentioned gestalt of operation, in the range which does not change the summary of invention, can deform suitably and can be performed. For example, in the gestalt of this operation, although the example which applied the automatic focus equipment and the automatic focus approach concerning this invention to the digital camera was explained, this invention is not restricted to this and can be applied to pocket information input units, such as PDA, etc. In short, in case an image is inputted, it can apply to all the equipments that perform AF.

[0079]

[Effect of the Invention] According to the automatic focus equipment concerning claim 1, a lens system carries out image formation of the photographic subject image to a predetermined location, an image pick-up means picturizes the photographic subject image inputted through a lens system, and outputs image data, and the 1st focus location detection means uses an image pick-up means. Move a lens system near the criteria location, sample the contrast of a photographic subject, detect a focus location, and the 2nd focus location detection means uses a different photo-electric-conversion means from an image pick-up means. Detect distance with a photographic subject, detect the focus location of a lens system, and a setting means responds to actuation of an operator. The operating condition of the 1st focus location detection means and/or the 2nd focus location detection means is set up. Since [a focus positioning means] a final focus location is determined based on the focus location detected with the 1st focus location detection means and the 2nd focus location detection means The effectiveness that the automatic focus equipment which it is a short time, and a focus location can be detected correctly, and can realize focus location detection actuation according to a user's liking and photography purpose can be offered is done so.

[0080] In the automatic focus equipment which is applied to claim 1 according to the automatic focus equipment concerning claim 2 moreover, a setting means Since the sampling range at the time of the 1st focus location detection means detecting the contrast of a photographic subject is set up according to actuation of an operator It becomes possible to determine any shall be thought as important between precision and a rate according to an operator's liking and application as the automatic focus equipment concerning claim 1 in addition to effectiveness.

[0081] In the automatic focus equipment which is applied to claim 1 according to the automatic focus equipment concerning claim 3 moreover, a setting means Since the number of sample takeoff points at the time of the 1st focus location detection means detecting the contrast of a photographic subject is set up according to actuation of an operator It becomes possible to determine any shall be thought as important between precision and a rate according to an operator's liking and application as the automatic focus equipment concerning claim 1 in addition to effectiveness.

[0082] Moreover, according to the automatic focus equipment concerning claim 4, in the automatic focus equipment concerning claim 1, since the sampling period at the time of the 1st focus location detection means detecting the contrast of a photographic subject is set up according to actuation of a photography person, a setting means becomes possible [determining any shall be thought as important between precision and a rate according to an operator's liking and application].

[0083] In the automatic focus equipment which is applied to any one of claim 1 – the claims 4 according to the automatic focus equipment concerning claim 5 moreover, a setting means According to actuation of a photography person, the priority of the 1st focus location detection means and the 2nd focus location detection means is set up. A focus positioning means Since a final focus location is determined based on the focus location detected with the 1st focus location detection means and the 2nd focus location detection means according to the set-up priority In addition to the effectiveness of the automatic focus equipment concerning any one of claim 1 – the claims 4, it becomes possible to raise the detection precision of a focus location more.

[0084] According to the automatic focus equipment concerning claim 6, moreover, automatic focus equipment ******** and the setting means concerning any one of claim 1 – the claims 5 Since it relates with the focal distance of a lens system and the operating condition of the 1st focus location detection means and/or the 2nd focus location detection means is set up according to actuation of an operator In addition to the effectiveness of the automatic focus equipment concerning any one of claim 1 – the claims 5, it enables an operator to set up the operating condition of AF according to a focal distance.

[0085] Moreover, according to the automatic focus equipment concerning claim 7, it sets to the automatic focus equipment concerning any one of claim 1 – the claims 6. Since said 1st focus location detection means and said 2nd focus location detection means were carried out to operating abbreviation coincidence when the photography operating member for directing photography was operated In addition to the effectiveness of the automatic focus equipment concerning any one of claim 1 – the claims 6, it becomes high speed more detectable [a focus location].

[0086] Moreover, according to the automatic focus equipment concerning claim 8, it sets to the automatic focus equipment concerning any one of claim 1 – the claims 6. Precede with actuation of the photography operating member for directing photography, and the 2nd focus location detection means performs ranging processing which ranges distance with a photographic subject at intervals of predetermined actuation. When a photography operating member is operated, the 1st focus location detection means Since actuation which detects a focus location by making into a criteria location the focus location detected with the 2nd focus location detection means is performed, in addition to the effectiveness of the automatic focus equipment concerning any one of claim 1 – the claims 6, it becomes high speed more detectable [a focus location].

[0087] Moreover, according to actuation of an operator since spacing of ranging processing of the 2nd focus location detection means of operation sets up, according to the automatic focus equipment concerning claim 9, in addition to the effectiveness of the automatic focus equipment concerning claim 8, a setting means becomes possible [determining spacing of Exterior AF of operation according to an operator's liking and application] in the automatic focus equipment concerning claim 8.

[0088] Moreover, since [according to the digital camera concerning claim 10] the automatic focus equipment concerning any one of claim 1 – the claims 9 is applied, the effectiveness that the digital camera which it is a short time, and a focus location can be detected correctly, and can realize focus location detection actuation according to a user's liking and photography purpose can be offered is done so.

[0089] Moreover, since [according to the pocket information input unit concerning claim 11] the automatic focus equipment concerning any one of claim 1 – the claims 9 is applied, the effectiveness that the information personal digital assistant equipment which it is a short time, and a focus location can be detected correctly, and can realize focus location detection

actuation according to a user's liking and photography purpose can be offered is done so.

[Translation done.]